

Claims

What is claimed is:

1. In a network comprising a plurality of router nodes connected in the network by communication links, a method of providing quality of service assurances for transmitting packets over a channel capable of transmission at a nominal bandwidth, the method comprising:

defining a plurality of classes, each of the class representing an aggregate behavior of packets;

allocating to each of the classes a nominal departure rate at which the packets of that class are transmitted when an available bandwidth of the channel is substantially operating at the nominal bandwidth; and

assuring each of the classes a minimum allocation of the available bandwidth for transmitting packets of that class if the available bandwidth of the channel is operating at less than the nominal bandwidth.

2. The method of claim 1 wherein the step of assuring a minimum allocation to each of the classes comprises assigning a percentage to each of the classes that represents a minimum percentage of the available bandwidth that is allocated to that class.

- 1 3. The method of claim 1 wherein the minimum allocations assured to the
2 classes are proportionally different than the nominal departure rates
3 allocated to these classes.
- 1 4. The method of claim 1 further comprising establishing a drop precedence
2 for each of the classes to determine a priority for dropping packets of that
3 class.
- 1 5. The method of claim 1 wherein the nominal departure rate assigned to
2 each of the classes by a given one of the router nodes is a percentage of a
3 nominal bandwidth of an outgoing communication link of that router
4 node.
- 1 6. The method of claim 1 wherein a given router node has a plurality of
2 outgoing communication links and the nominal departure rate allocated
3 to a given class is different for the different outgoing communication
4 links.
- 1 7. The method of claim 1 wherein the nominal departure rate allocated to a
2 given class is different for different router nodes.
- 1 8. The method of claim 1 wherein a given router node has a plurality of
2 outgoing communication links and the nominal departure rate together
3 with the assured minimum allocation allocated to a given class is
4 different for the different outgoing communication links.

- 1 9. The method of claim 1 wherein the nominal departure rate together with
2 the minimum allocation allocated to a given class is different for different
3 router nodes.
- 1 10. The method of claim 1 further comprising dropping packets from queues
2 to limit the delay at a given router node.
- 1 11. The method of claim 10 further comprising attaining the minimum
2 allocations assured to each of the service classes by providing an
3 alternate route for packets of service classes in accordance with the rate
4 priorities assigned to the service classes.
- 1 12. The method of claim 1 wherein at least one of the communication links is
2 a wireless link.
- 1 13. The method of claim 1 further comprising assigning scheduling priorities
2 to the classes based on a criterion.
- 1 14. The method of claim 13 wherein the criterion is a delay that each class
2 can tolerate.
- 1 15. The method of claim 1 further comprising dynamically changing the
2 nominal departure rate allocations to one of the classes
- 1 16. The method of claim 1 further comprising dynamically changing the
2 minimum allocations allocated to the classes.

1 17. In a network, a router node capable of supporting differentiated services,
2 the router node comprising:

3 a classifier defining a plurality of classes, each of the classes
4 representing an aggregate behavior of packets;

5 an allocator allocating to each of the classes a nominal departure
6 rate at which the packets of that class are transmitted when an available
7 bandwidth of the channel is substantially operating at the nominal
8 bandwidth; and

9 a rate prioritizer assigning to each of the classes a minimum
10 allocation of the available bandwidth for transmitting packets of that
11 class if the available bandwidth of the channel is operating at less than
12 the nominal bandwidth to provide quality of service assurances for
13 transmitting packets over the network.

1 18. The router node of claim 17 further comprising a plurality of outgoing
2 communication links, and wherein the nominal departure rate allocated
3 to a given class is different for different outgoing communication links

1 19. The router node of claim 17 further comprising a plurality of outgoing
2 communication links, and wherein the nominal departure rate together
3 with the assured minimum allocation allocated to a given class is
4 different for different outgoing communication links

1 20. An article of manufacture having computer-readable program means
2 embodied thereon for providing quality of service assurances for
3 transmitting packets over a channel capable of transmission at a
4 nominal bandwidth, the article comprising:

5 computer-readable means for defining a plurality of classes, each
6 of the class representing an aggregate behavior of packets;

7 computer-readable means for allocating to each of the classes a
8 nominal departure rate at which the packets of that class are
9 transmitted when an available bandwidth of the channel is substantially
10 operating at the nominal bandwidth; and

11 computer-readable means for assuring each of the classes a
12 minimum allocation of the available bandwidth for transmitting packets
13 of that class if the available bandwidth of the channel is operating at less
14 than the nominal bandwidth.